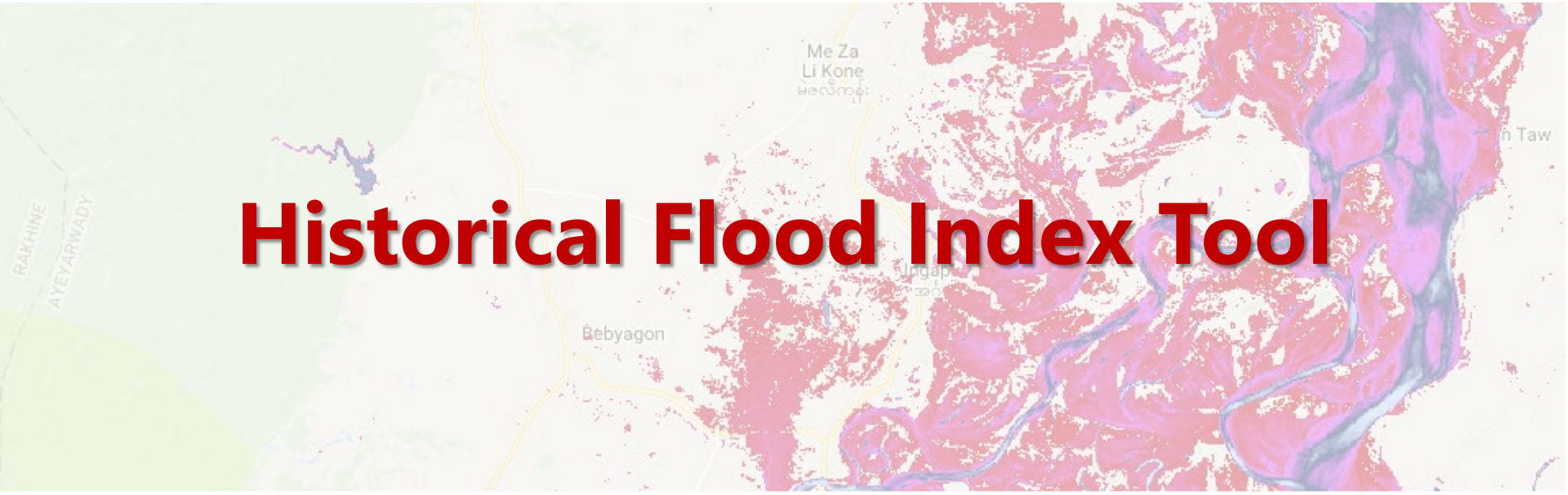


Historical Flood Index Tool

Kittphong Phongsapan,
GIS/RS Specialist

About the tool

"This tool use historical flood frequency mapping and turns it into flood hazard and exposure analysis. It aims to support decision maker for planning and flood preparedness"

Introduction

Flood hazard mapping approach

Modeling-based approach

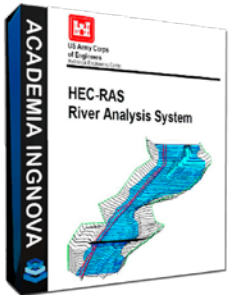
RS data analysis approach

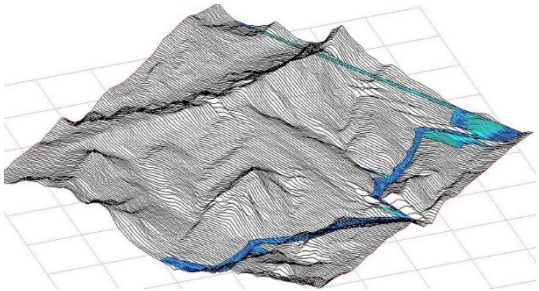
Introduction

Flood modeling-based approach

Requirements:

- Modeling software
  - Hydrological model
  - Hydraulic model
- Data
  - Precipitation, discharge
  - Cross sections
  - Land cover map





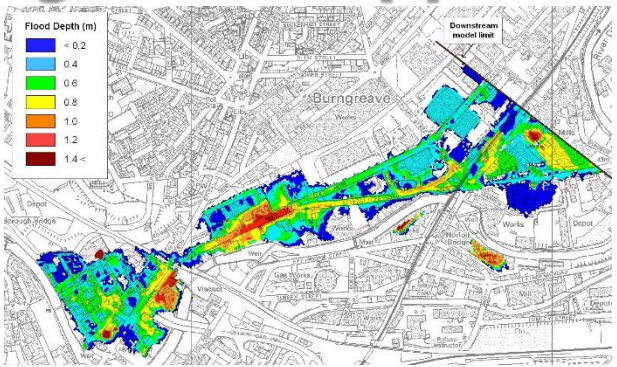
MIKE by DHI

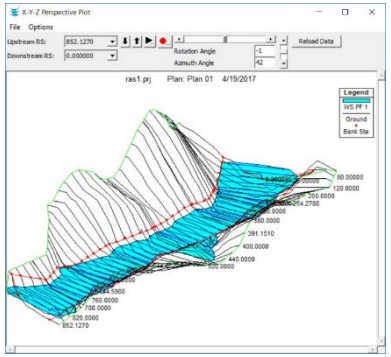
Introduction

Flood modeling-based approach

Result

- Flood inundation
- Flood depth
- Velocity/duration of the flood





To be Consider:

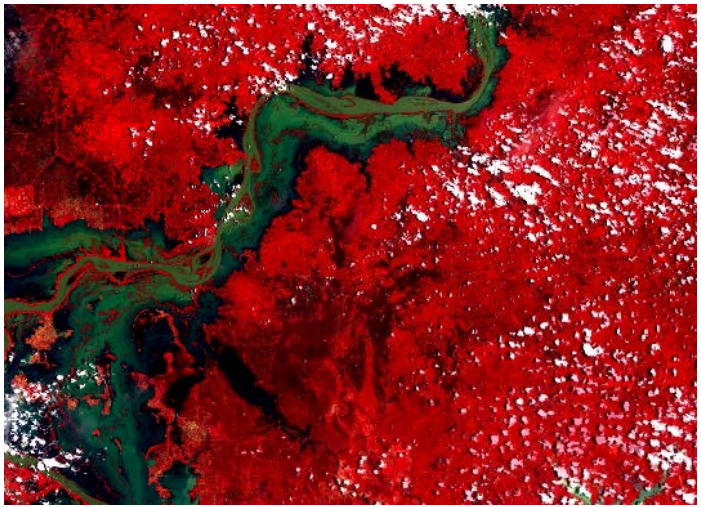
- **Time**
- **Human resource (Hydrologist/Meteorologist)**
- **Software**

Introduction

RS data analysis approach

Requirements:

- Satellite imagery
- RS analysis skill
- Programming skill



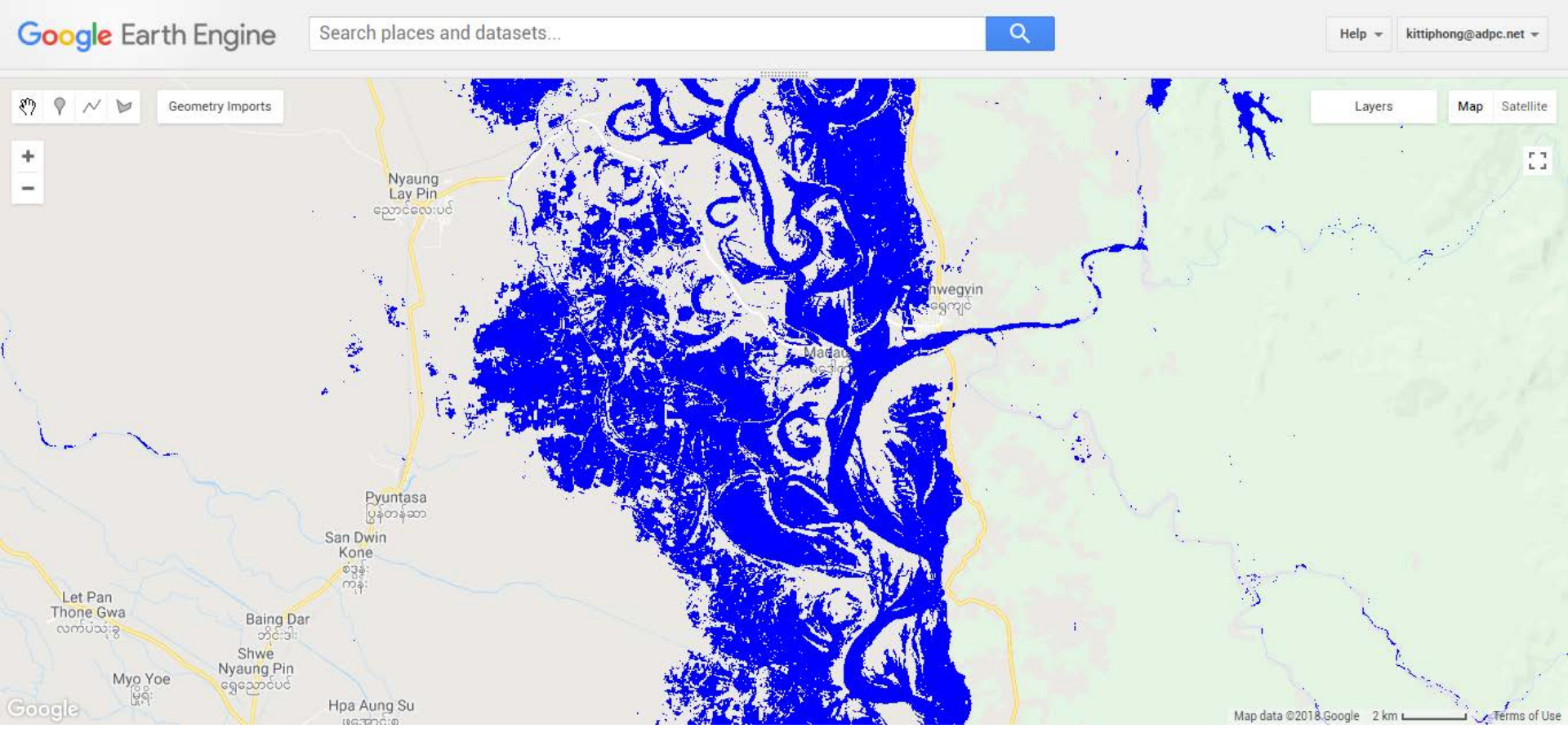
Introduction

RS data analysis approach

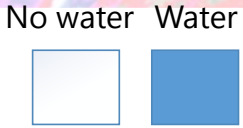
Process:

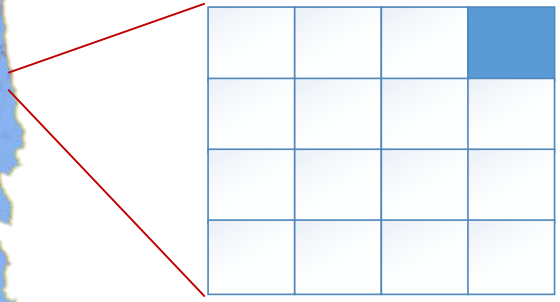
- Using Satellite imagery
- Extract water from each images
- Calculate the frequency of water occurrence

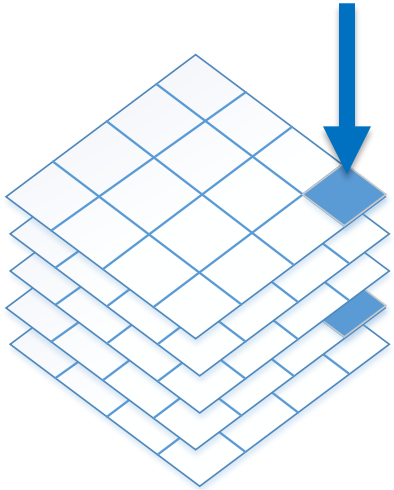
Introduction



Methodology







Percentage of water occurrence

2 times of water occurrence out of 5 observation layers

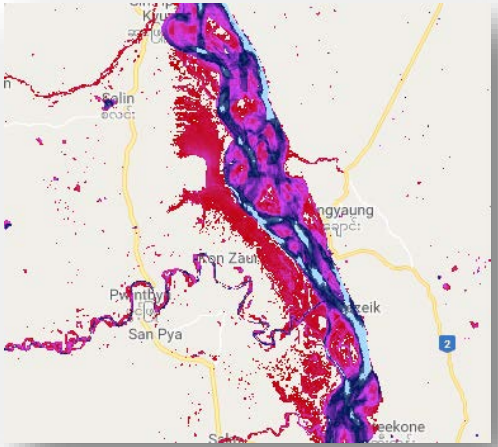
2/5 = 40 %

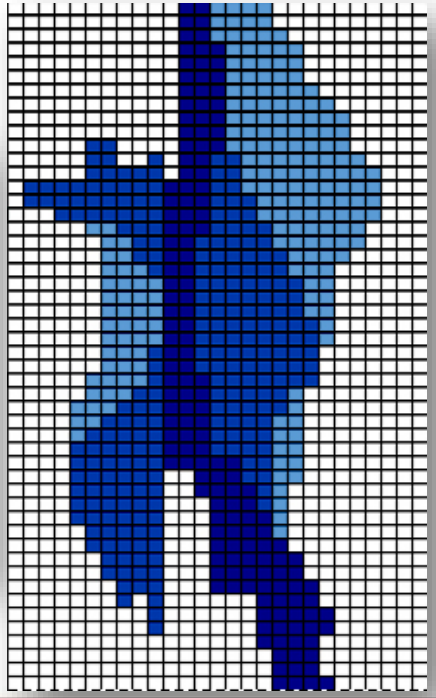
Introduction

RS data analysis approach

Result:

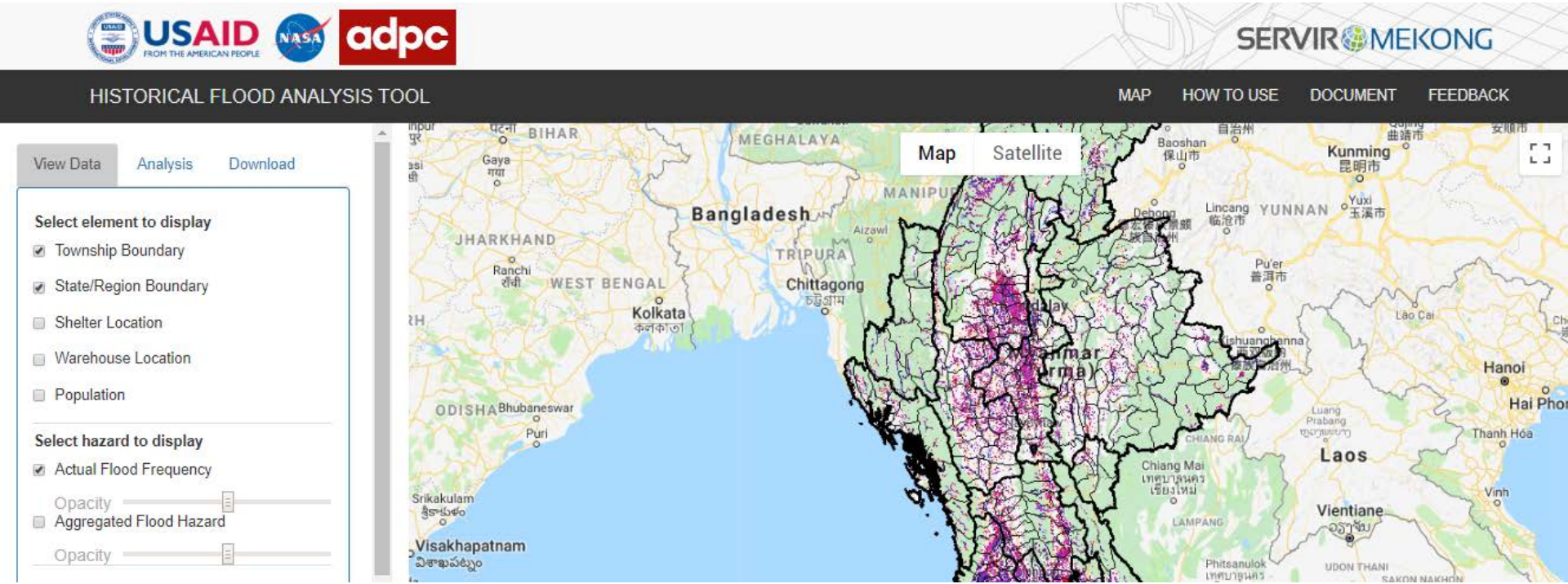
- Flood frequency map





To be easier to use the data, we developed the tool

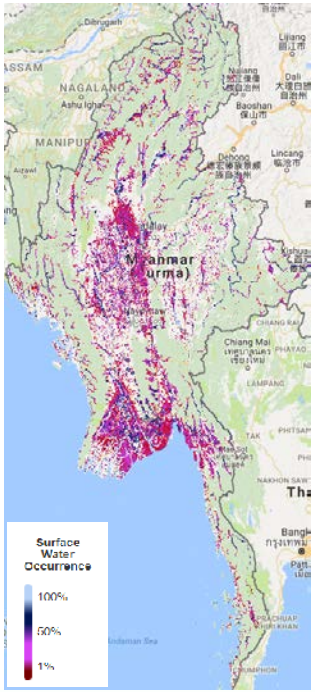
Historical Flood Analysis Tool

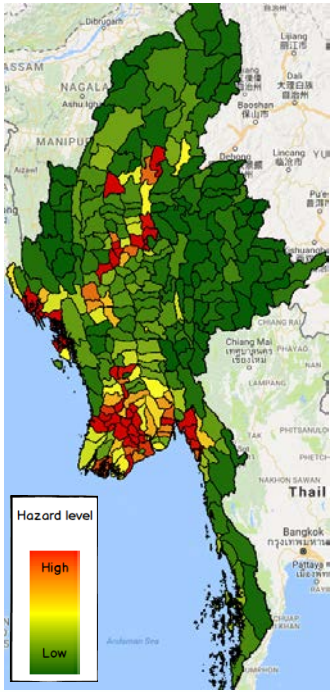


Historical Flood Analysis Tool

The tool provides :

- Flood frequency map
- Flood hazard index map
- Exposure result





Flood Frequency Dataset

GEE
Analysis platform

JRC
Global Surface Water Dataset

3,066,102
scenes analyzed

Landsat 5, 7, 8
From 1984 - 2015

30+ years
of satellite data

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380 layers
of monthly surface water occurrence

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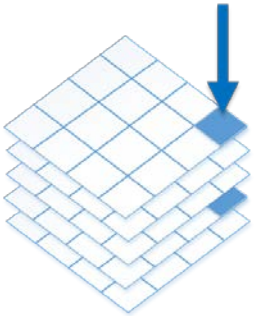
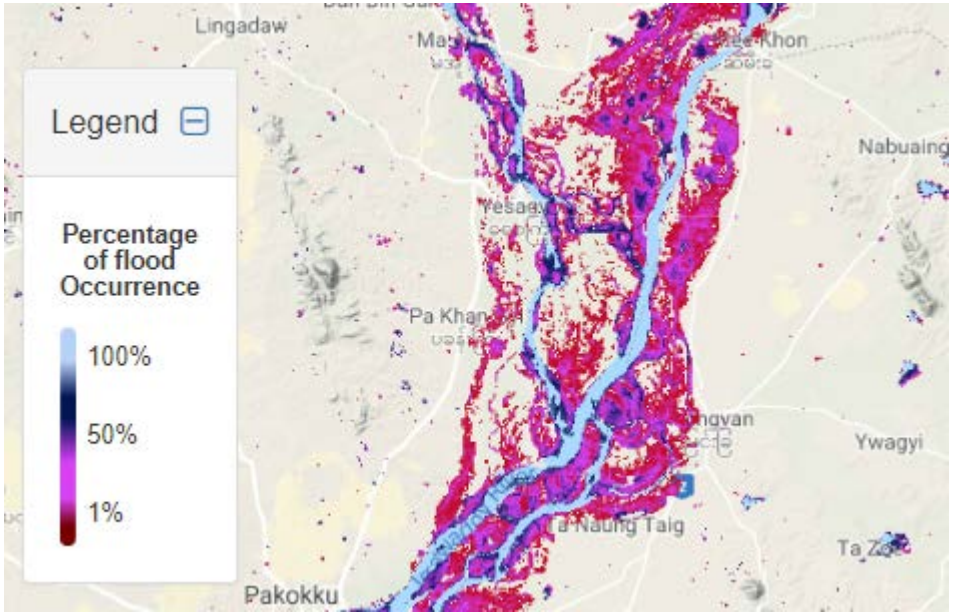
Flood frequency map

- Surface water extraction
- Calculate the frequency of water occurrence

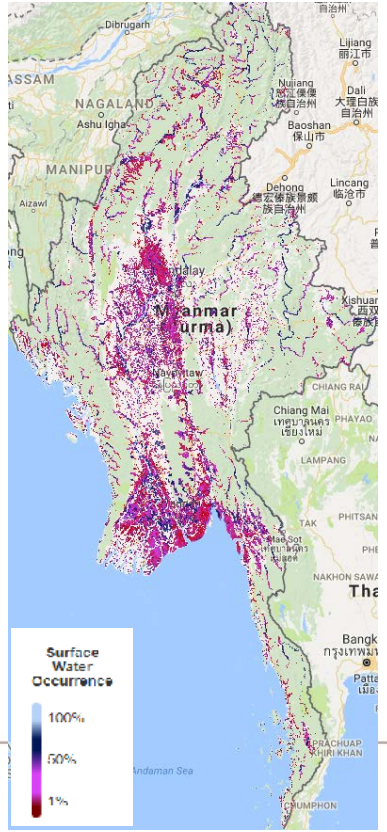


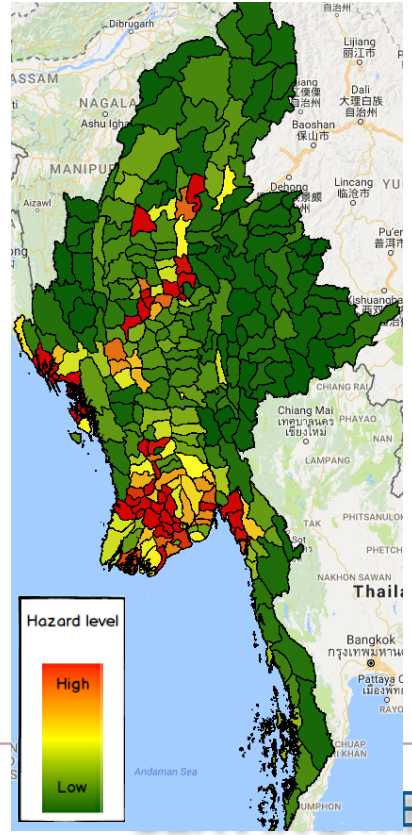


Flood hazard index map

JRC

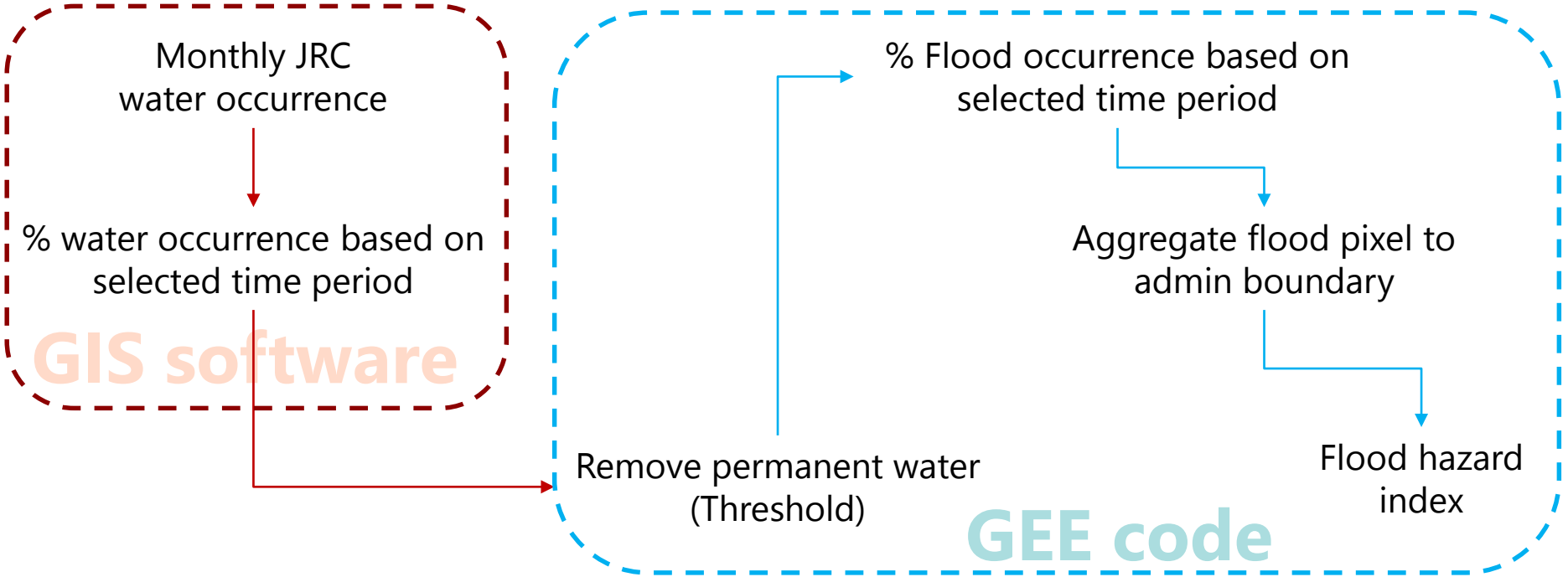
% frequency of surface water occurrence





Flood hazard index

Method : Flood Hazard Index



Method : Flood Hazard Index

Monthly JRC water occurrence

↓

% water occurrence based on selected time period

GIS software

To find the threshold to distinguish permanent water and flood:

- Use Pre flood water (permanent water) from UNOSAT flood 2015 as a based to extract JRC surface water as the same year
- Use function “Extract by mask” of ArcGIS to do the process above
- Once we got JRC surface water extracted we could assume that the water is permanent water
- Average the pixel value of permanent water to be the threshold value to be used as a separator permanent water and flood in the next process

Method : Flood Hazard Index

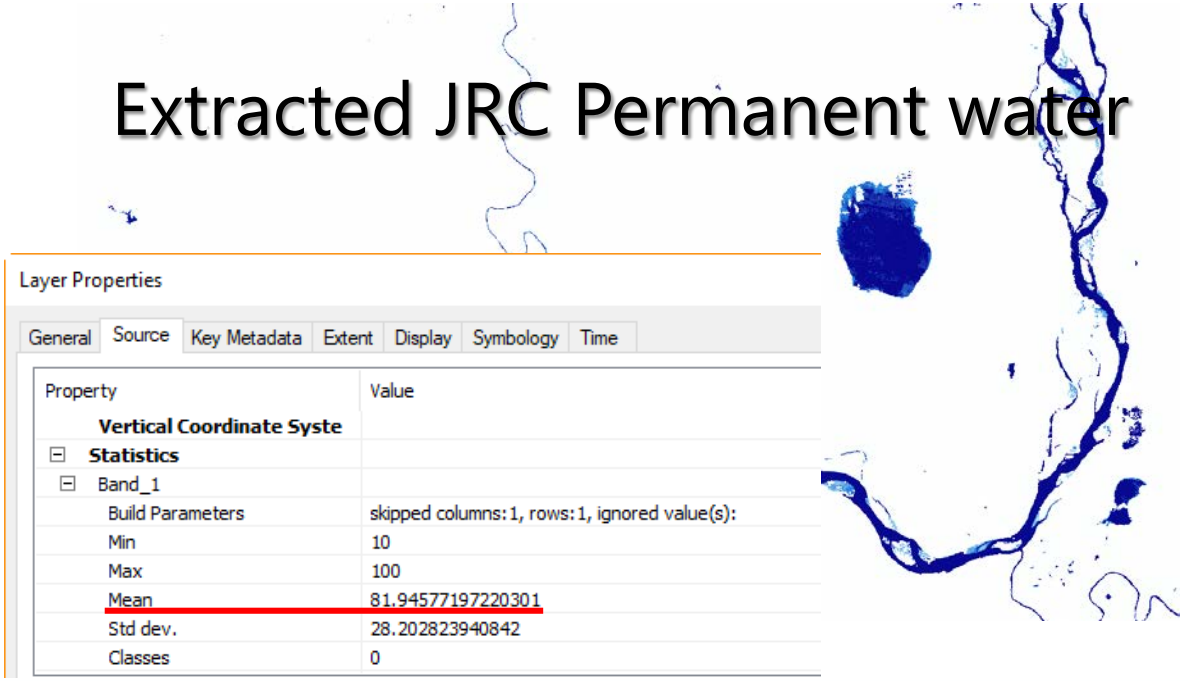
Monthly JRC
water occurrence

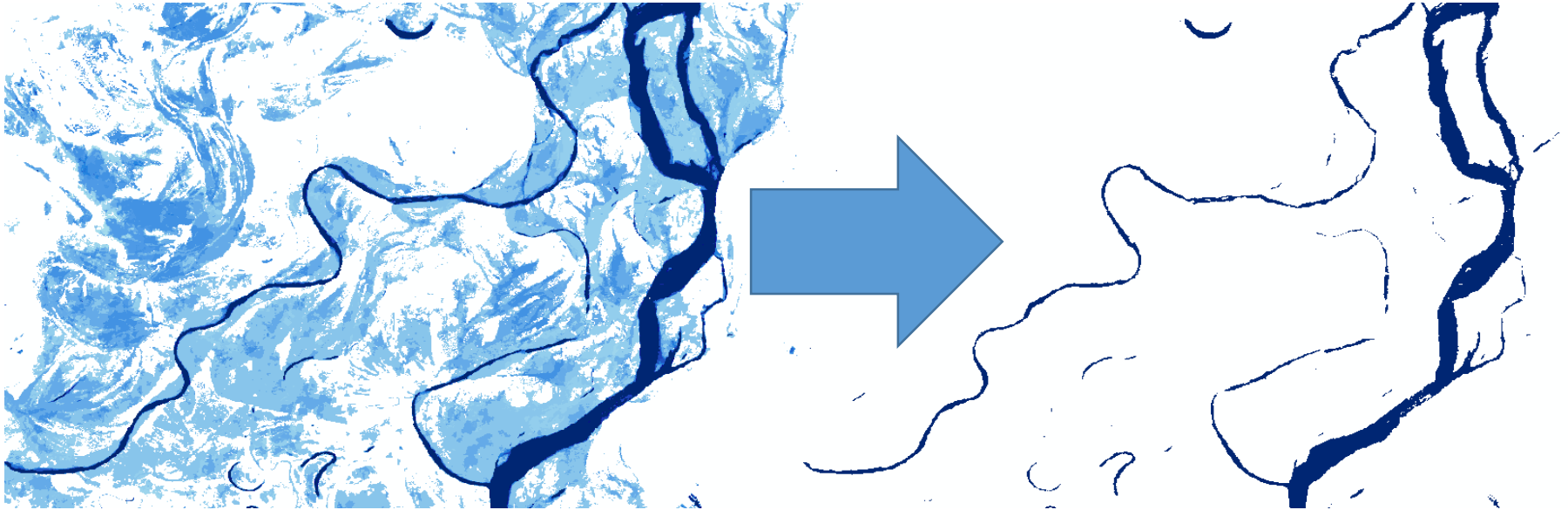
↓

% water occurrence based on
selected time period

GIS software

Extracted JRC Permanent water





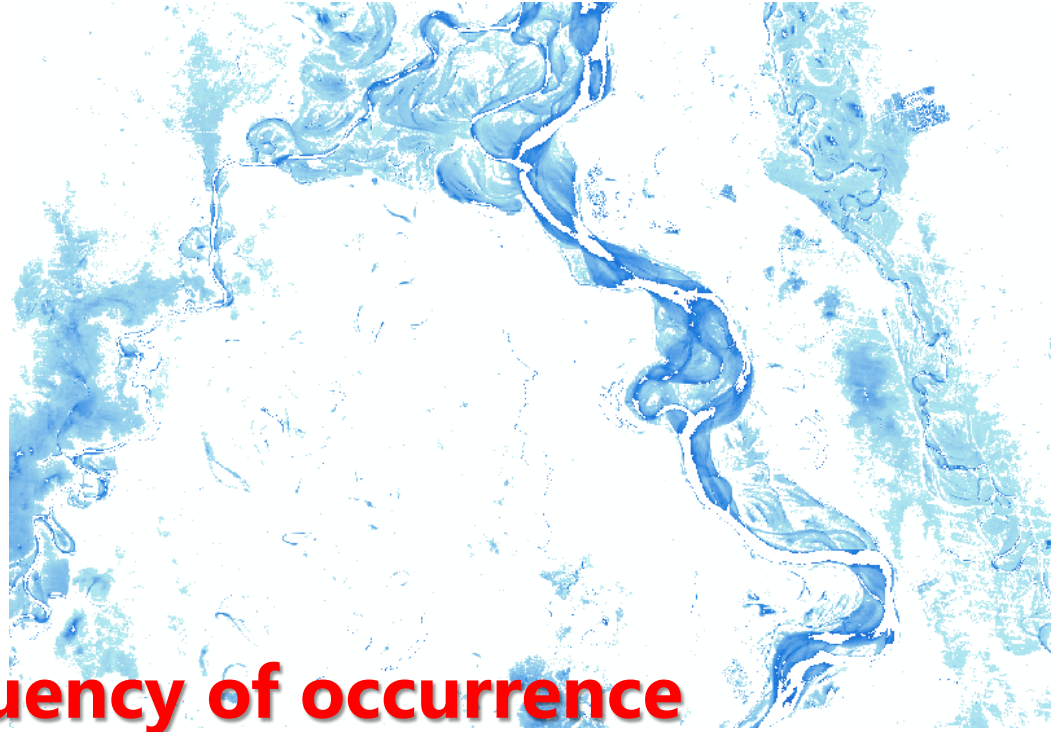
Method : Flood Hazard Index

Monthly JRC
water occurrence

↓

% water occurrence based on
selected time period

GIS software



Threshold = 82% frequency of occurrence

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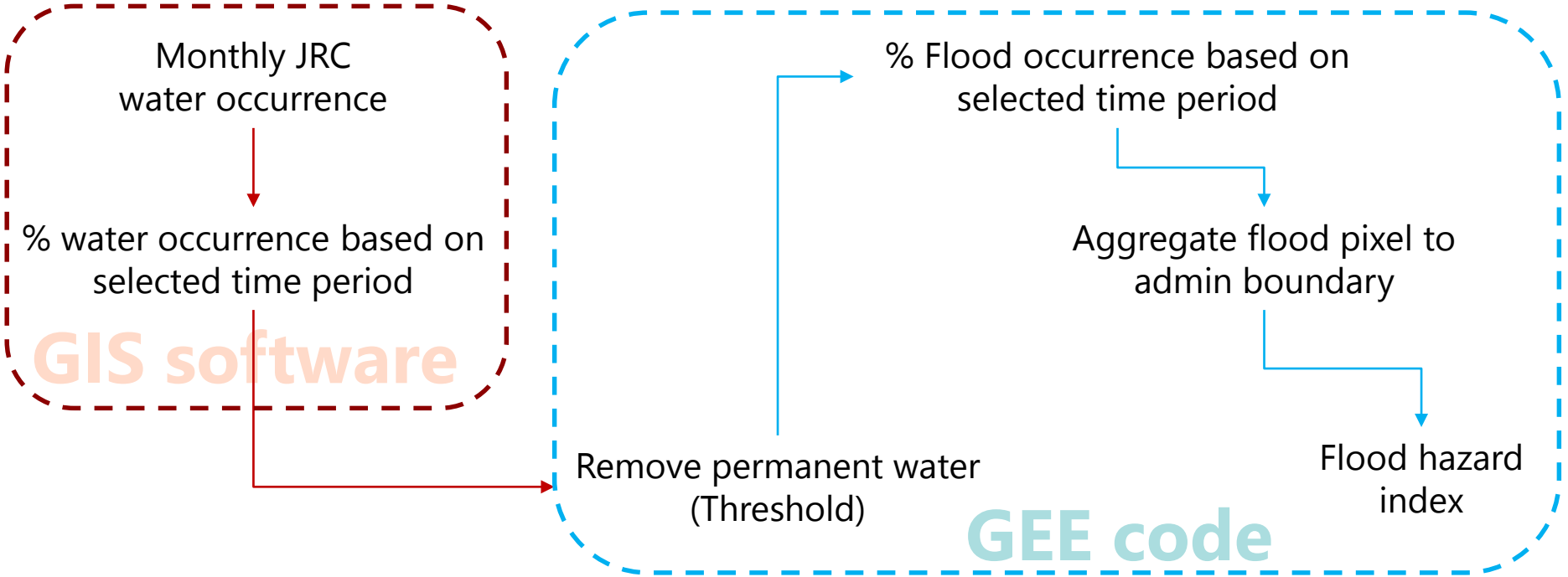
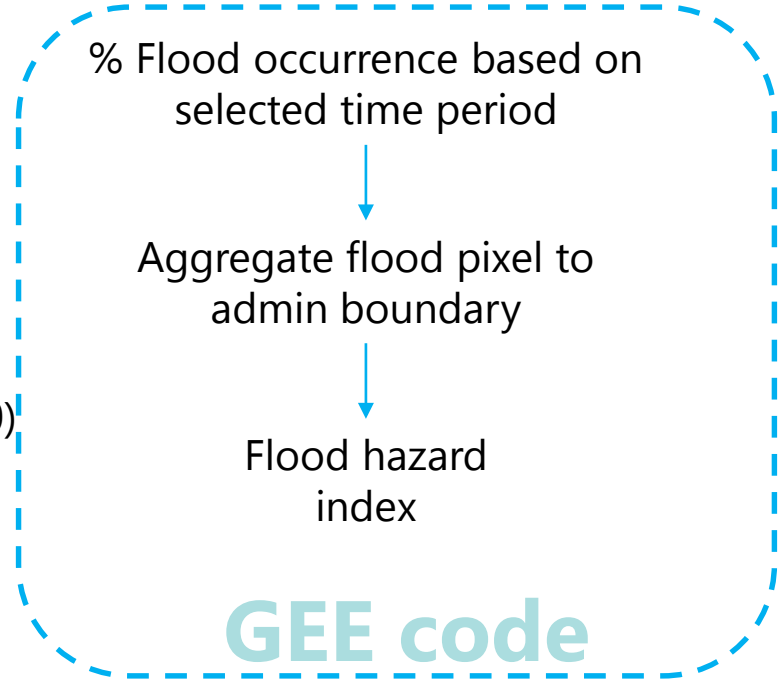
Method : Flood Hazard Index



Method : Flood Hazard Index

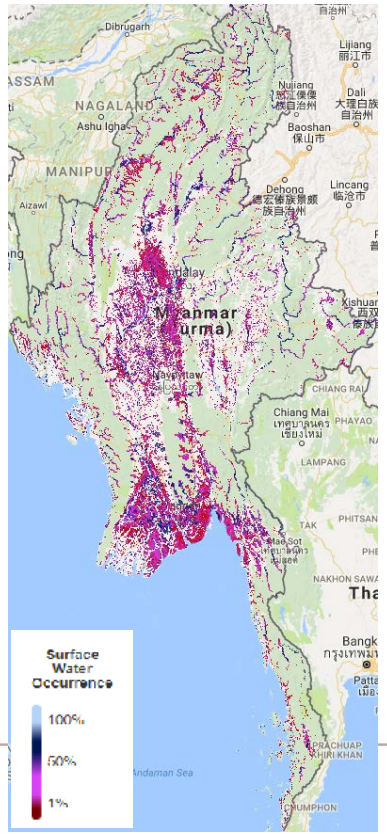
To aggregate flood frequency in to admin. boundary:

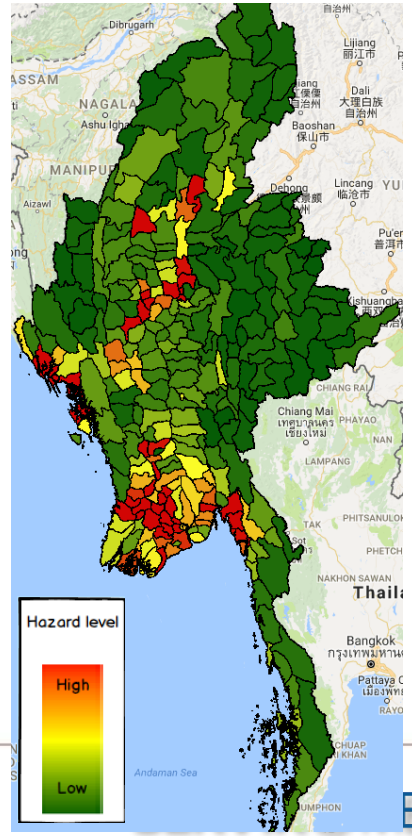
- Township boundary is used for representing flood index
- Aggregate by sum up all the pixel value in township then divide by township area
- Find the max and min of then range those up (0 -100)
- Classify into low moderate and high flood index



Method : Flood Hazard Index

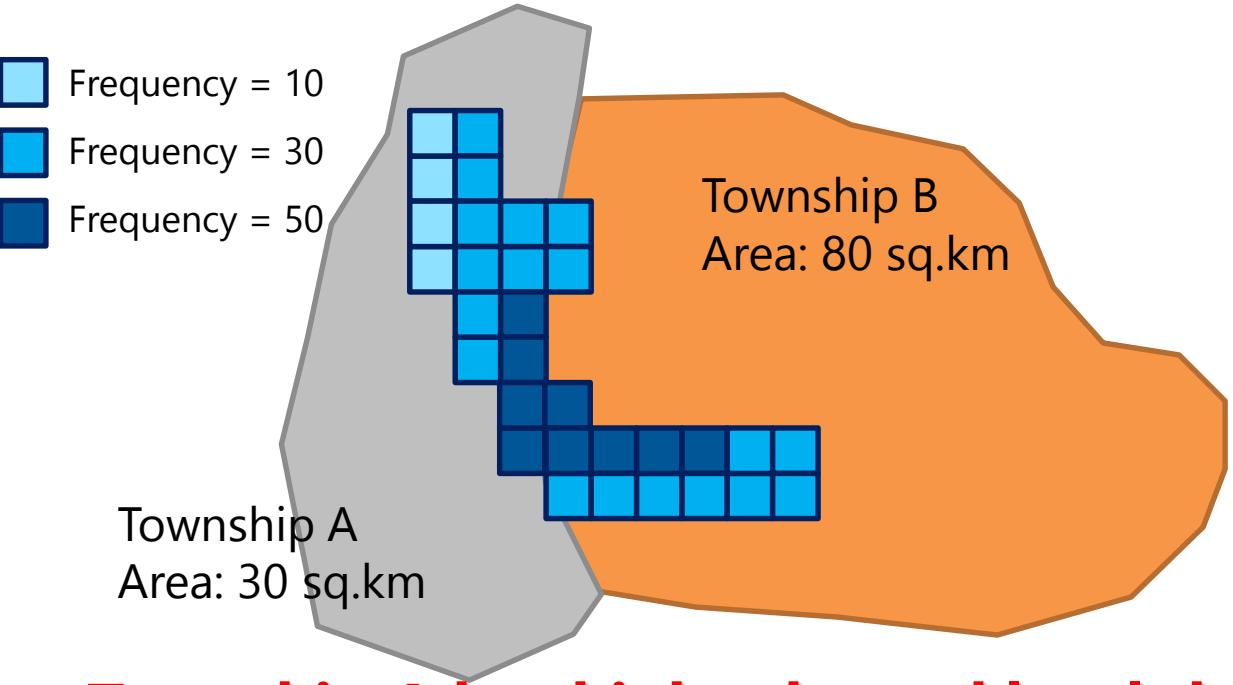
JRC
% frequency of surface water occurrence





Flood hazard index

Method : Flood Hazard Index



Flood index for Township A

$$= \frac{(10 \times 4) + (30 \times 8) + (50 \times 4)}{30}$$

$$= 16$$

Flood index for Township B

$$= \frac{(0 \times 4) + (30 \times 8) + (50 \times 5)}{80}$$

$$= 6.13$$

Township A has higher hazard level than Township B

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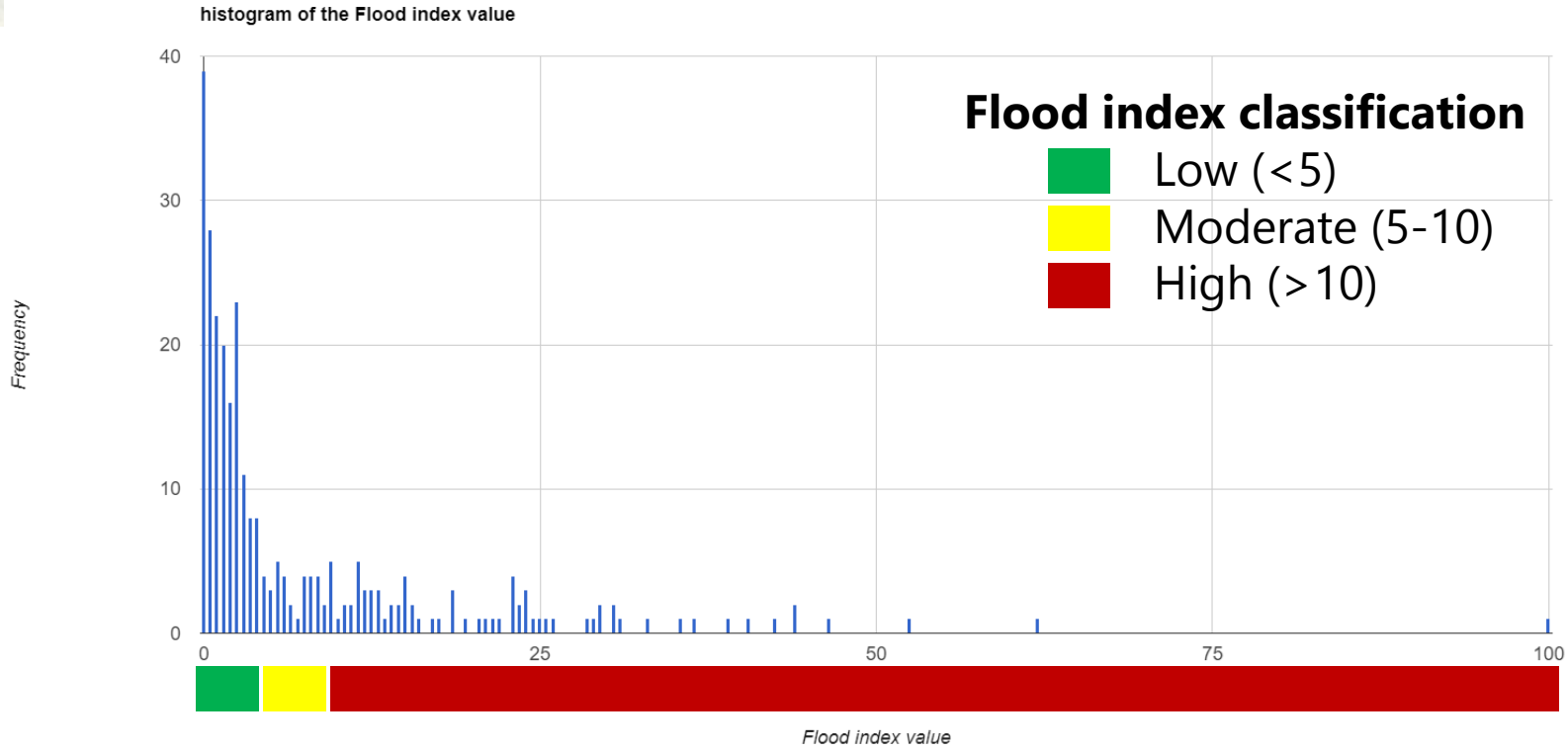
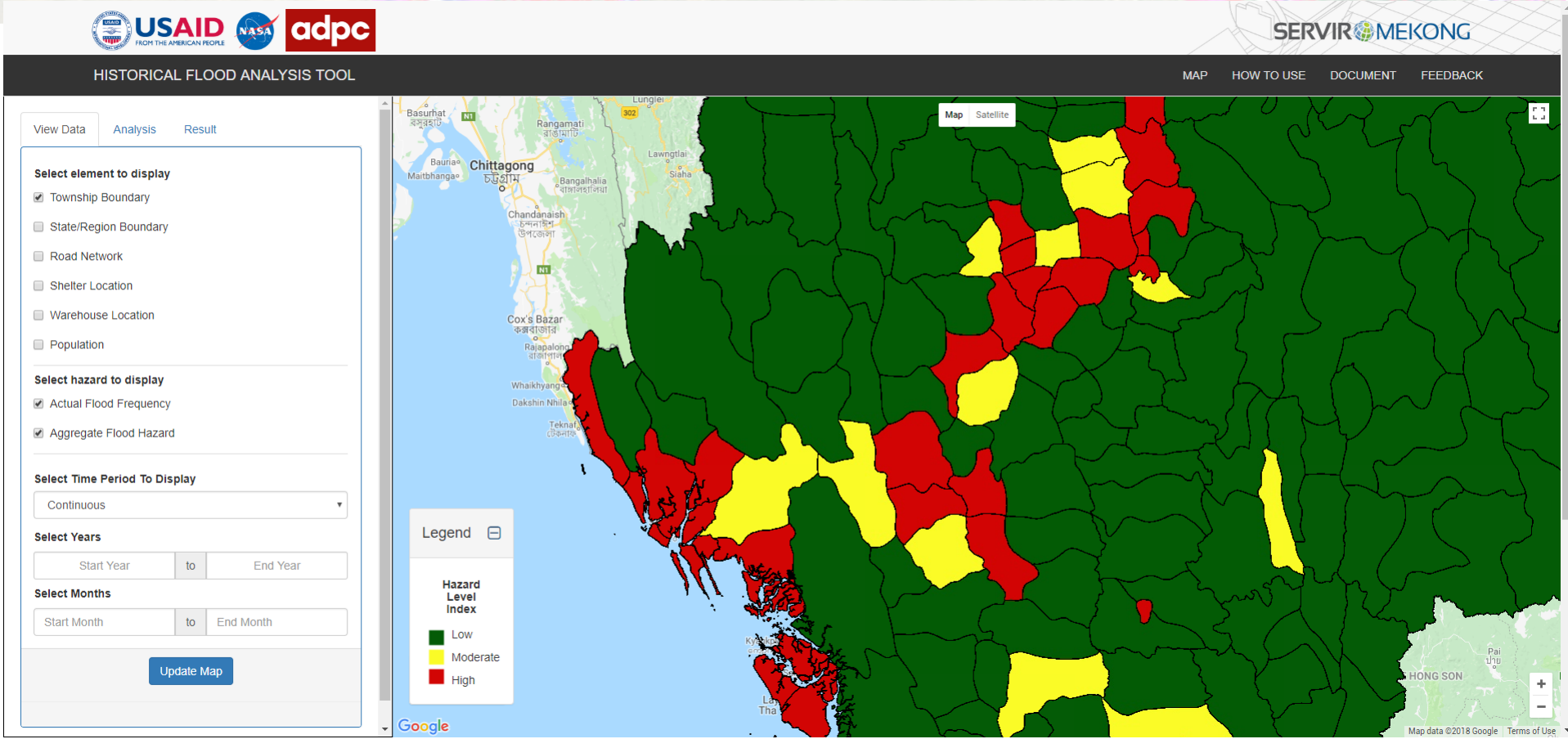
Flood index histogram & flood index classification



Overall idea of the tool



Limitation of the tool

- The tool is not for flood emergency response or flood real-time monitoring
- The map represents flood frequency for entire selected time period not the individual flood event
- Landsat has revisit the same area every 16 days. Hence, some historical flood events might not be captured
- Observation might have been compromised by atmospheric conditions
- The color in the map represents the percentage of frequency not the depth of the water

Un-official link of the tool

http://dev.gymlog.co

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Thank you